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Rearing Leaf-Miners from Eupatorium Rugosum

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REARING LEAF-MINERS FROM

EUPATORIUM RUGOSUM

(TITLE)

BY

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INTRODUCTION

Leaf-miners have been observed by biologists and naturalists for many years. One of the early reports was written by DeGeer in 1837. His account is colorfully written and shows that he observed these tiny insects with great care and interest.

All of the leaf-miners are larvae. There are four great groups that have been able to adapt themselves to the narrow, but food-laden confines of the leaf. These groups are as follows: fly larvae, beetle larvae, sawfly larvae, and moth larvae.

Although the adults of these four groups are quite different in appearance there is a great similarity in the appearance of their larvae. In general, the head is rather wedge-shaped in the lateral view. The leaf-miners are very pliable which is a necessity demanded by the environment and thus may change the body shape. The growth of external appendages is greatly reduced. The body itself is usually rather long and cylinderical.

Leaf-miners hatch from eggs usually deposited on or in the leaf. As the eggs hatch the larvae begin the task of consuming the interior of the leaf. Some miners consume the palisade layers, some consume the spongy layer, and others consume both layers. Thus, by consuming the interior of the leaf, a visible mine is constructed that may be easily

observed. Leaf mines themselves fall into two general types, the linear type and the blotch type. As the larvae grow they shed the old exoskeleton within the mine. As most miners moult into succeeding instars they become less like the original generalized larval form.

Some leaf-miners pass into the pupal stage within the mine and others leave the mine and burrow into the soil to complete pupation. Upon the completion of the transformation that takes places within the pupal cuticula the adult insect emerges to start a new generation.

From an economic standpoint, the leaf-miners are not too important, as they do not damage the leaf greatly.

Usually a leaf that has a mine in it is still quite healthy and can still function properly. There are some plants that we use that are hosts to leaf-miners, such as the tobacco plant, apple trees, wheat, beet plants, coffee trees, and the maple tree. It is, in this case, reasonable to assume that the miners do some economic damage, but it is not a large loss to our food supply (Needham, et al., 1928).

PURPOSE

The project was undertaken primarily with the intent of establishing the host of Oenonogastra microrhopalae (Ashm.), one of the small exodont braconids. Where careful rearings of these parasitic wasps have been made it has been found that the host is a dipterous insect. Since Oenonogastra microrhopalae is known to frequent Eupatorium rugosum (Hout.), white snakeroot, (Riegel, 1963), which is the host plant of some dipterous leaf miners, it was thought to be the ideal plant from which to collect specimens.

In an attempt to become more familiar with leaf mining insects and their life cycles, several specimens were taken from plants other than white snakeroot. This served as a secondary objective of the project.

METHODS

One of the first tasks was to find a rather large number of white snakeroot plants. This plant is an erect, branching, warm-season perennial that grows from one to five feet tall. The leaves, from two to five inches long, are opposite, broad at the base but pointed, coarsely toothed, with three main veins. White snakeroot is found growing in wooded areas,

length of the larval period is compared between the serpentine and blotch miners, it is easy to see that the blotch mining types of Agromyza would have a much higher exposure to parasites.

In collecting it is not advisable to collect specimens that have not had sufficient time to develop to a rather mature stage. Several that were collected, being about one millimeter in length, were not developed well enough to permit pupation and perished in the larval stage. All specimens that were at least two millimeters in length went on to pupation and completed their emergence as adult insects.

Upon completion of each collecting trip the specimens were taken to the laboratory for rearing. Each specimen was placed in a separate container as soon as possible because fully mature larva often pupate within twenty-four hours. Normally the fly larvae leave the mine to complete the pupal stage by burrowing into the soil and leaf cover on the ground. If the miners complete pupation within the collecting jar there may be no way of knowing from which mine the specimen came, therefore it is important to keep them separate. The mine itself can give much valuable information which will help in identifying the specimen. Each leaf should be preserved if at all feasible and labeled for easy identification.

The rearing containers selected were glass jars, which had a total capacity of seventy milliliters. This type

container has several advantages in that one may place necessary marks on the jar, the specimen is easily observed, and upon emergence the adult insect has room to move about normally. Another important factor which may be controlled by using airtight containers is the humidity. One drop of water was added to each jar to maintain the necessary moisture within the container. This small amount was found to be satisfactory, though very little experimentation was done on this factor.

As the insects emerged from the pupal stage they were allowed to move about within the container for several hours. Most of the specimens were killed in a cyanide jar. The specimens were pinned while they were still soft and pliable. A specimen is very hard to mount if allowed to dry out, because of the very small size of the adult insect.

With each adult insect the puparium or pupal skin from which it emerged was mounted. Quite often the larval form is parasitized and the adult which emerges is a parasite, rather than the insect which would normally emerge from the pupal cuticula.

RESULTS

In going over the specimens reared from Eupatorium rugosum we find some very interesting results. The commonest leaf-miners were the flies; which accounted for seventy-five per cent of all the specimens collected. They were also the most parasitized with forty-five per cent of them serving as hosts.

The only parasites which came from the fly puparia were small chalcid wasps.

Of the other specimens reared three were small moths and four were chrysomelid beetles. One of the most interesting events that came about during the project was centered about one of the larval moths. It had come out of the mine and did not complete pupation. All development stopped. Several days later there were eleven wasps, that came from the emptied larval skeleton.

Some miners were reared from plants other than the white snakeroot. Several dipterous specimens were collected from bottlebrush grass. Quite often there were several miners in one leaf. The specimens that were collected from bottlebrush grass were all parasitized by the chalcid wasps. I did not obtain a single adult fly from this plant.

Some dipterous specimens were collected from composites, mostly sunflowers. From this group of leaf-miners, which were mostly parasitized, came a different type of wasp. The miners were hosts to a small cynipid wasp.

The most interesting part of the project was in observing what emerged from the different puparia. Quite often as the specimens show, an insect emerges which is not expected, and reveals to the worker another small part of the balance which is inherent in nature.

Rearing results are shown in the following accession list of specimens.

Accession Number 1

Collected 6-11-63 in Fox Ridge on Eupatorium rugosum

Emerged on 6-20-63 - Blotch type mine, frass dispersed - moth

Accession Number 2

Collected 6-13-63 at Fox Ridge on E. rugosum

Emerged 6-22-63 - Blotch mine, frass dispersed - moth

Accession Number 3

Collected 6-13-63 at Fox Ridge on E. rugosum

Emerged 6-22-63 - Blotch mine, frass dispersed - moth

Accession Number 4

Collected 6-13-63 at Fox Ridge on ironwood, Ostrya virginiana (Mill.)

Pupation on 6-20-63 in leaf

Emerged on 7-2-63 - chalcid

Accession Number 5

Collected on 6-16-63 at Mattoon, Illinois, on Hystrix patula (Moench)

Emerged on 7-5-63

Mine at leaf tip with three specimens inside.
Pupation within the leaf, all parasitized by chalcids.

Accession Number 6

Collected 6-27-63 at Fox Ridge on E. rugosum

Pupation out of leaf on 6-29-63

Emerged on 7-12-63

Blotch mine, frass dispersed in mine - fly

Accession Number 7

Collected 6-27-63 at Fox Ridge on E. rugosum

Pupation out of leaf on 6-29-63

Emerged on 7-12-63

Blotch mine, frass dispersed in mine - fly

Accession Number 8

Collected on 6-19-63 at Fox Ridge on E. rugosum

Emerged on 7-20-63

Pupation out of leaf - chalcid

Accession Number 9

Collected on 7-9-63 at Fox Ridge on E. rugosum

Pupation in leaf

Emerged on 7-19-63

Frass dispersed in narrow lines, lines run in all directions - Anoplitis inaequalis (Weber)

Accession Number 10

Collected 6-27-63 at Fox Ridge on E. rugosum

Pupation, out of leaf on 6-29-63

Emerged on 7-15-63 - fly

Accession Number 11

Collected 6-27-63 at Fox Ridge on E. rugosum

Pupation, out of leaf on 6-29-63

Emerged on 7-15-63

Mine was blotch type - fly

Accession Number 12

Collected on 6-27-63 at Fox Ridge on E. rugosum

Emerged on 7-14-63

Pupation out of leaf - fly

Accession Number 13

Collected on 6-27-63 at Fox Ridge on E. rugosum

Emerged on 7-14-63

Pupation out of leaf - fly

Accession Number 14

Collected on 6-27-63 at Fox Ridge on E. rugosum

Emerged on 7-15-63

Pupation out of leaf - fly

Accession Number 15

Collected on 6-27-63 at Fox Ridge on E. rugosum

Emerged on 7-15-63

Pupation out of leaf - fly

Accession Number 16

Collected on 6-27-63 at Fox Ridge on E. rugosum

Emerged on 7-15-63

Pupation out of leaf - fly

Accession Number 17

Collected on 7-9-63 at Fox Ridge on Aster

Emerged on 7-15-63

Pupation in leaf - blotch mine frass in lines - A. inaequalis

Accession Number 18

Collected on 7-3-63 at Fox Ridge on E. rugosum

Emerged on 7-26-63

Pupation out of leaf - chalcid emerged

Accession Number 19

Collected on 7-3-63 at Fox Ridge on E. rugosum

Emerged on 7-28-63 - chalcid

Accession Number 20

Collected on 7-9-63 at Fox Ridge on a composite

Emerged on 7-28-63 - cynipid

Accession Number 21

Collected on 7-29-63 at Fox Ridge on E. rugosum

Emerged on 7-30-63

Pupation in leaf - A. inaequalis

Accession Number 22

Collected on 7-23-63 in Mattoon on Hystrix patula

Emerged on 8-6-63 - chalcids

Accession Number 23

Collected on 7-9-63 at Fox Ridge on E. rugosum

Emerged on 8-10-63 - chalcid

Accession Number 24

Collected on 7-9-63 at Fox Ridge on E. rugosum

Emerged on 8-10-63 - chalcid

Accession Number 25

Collected on 7-23-63 at Fox Ridge on E. rugosum

Left mine 8-10-63 - larval moth out of leaf - 11 wasps emerged

Accession Number 26

Collected 7-23-63 at Fox Ridge on ironwood

Emerged 8-10-63 - pupated in leaf, spun a pupal case in leaf - moth

Accession Number 27

Collected on 7-23-63 at Fox Ridge on E. rugosum

Emerged on 8-11-63 - A. inaequalis

Accession Number 28

Collected on 7-29-63 at Fox Ridge on E. rugosum

Emerged 8-13-63 - fly

Accession Number 29

Collected on 7-31-63 at Fox Ridge on E. rugosum

Emerged on 8-19-63 - chalcid

Accession Number 30

Collected on 7-31-63 at Fox Ridge on E. rugosum

Emerged on 8-21-63 - chalcid

Accession Number 31

Collected on 7-31-63 at Fox Ridge on a composite

Emerged on 8-26-63 - cynipid

Accession Number 32

Collected 7-31-63 at Fox Ridge on a composite

Emerged 8-28-63 - cynipid

Accession Number 33

Collected 8-15-63 at Fox Ridge on E. rugosum

Emerged on 9-2-63 - fly

Accession Number 34

Collected 8-15-63 at Fox Ridge on E. rugosum

Emerged on 9-2-63 - fly

Accession Number 35

Collected 7-29-63 at Fox Ridge on E. rugosum

Emerged 9-10-63 - chalcid

Accession Number 36

Collected 7-29-63 at Fox Ridge on E. rugosum

Emerged 9-12-63 - chalcid

Accession Number 37

Collected 6-27-63 at Fox Ridge on E. rugosum

Emerged on 10-2-63 - chalcid

The specimens listed in the accession list as "fly" all seem to be the same species of Agromyza of the family Agromyzidae. The moths in the collection are probably Acrocercops venustella (Clem.), of the family Gracilariidae.

CONCLUSION

In conclusion to the project, even though the host of Oenonogastra microrhopalae was not found, it may be stated that dipterous leaf-miners are highly parasitized by wasps. As the braconids are parasites and Oenonogastra microrhopalae has been collected near white snakeroot plants it is very probable that it may be a parasite on the dipterous leaf-miners. It is hoped that in the future the true host of this tiny braconid wasp will be established.

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